

WHAT IS CLAIMED IS:

1. An apparatus comprising:
a VCSEL (vertical cavity surface emitting laser) formed on a top surface of a
5 substrate that is transmissive to light emitted by the VCSEL;
a photodetector disposed facing an opposed bottom surface of the substrate
and capable of detecting light emitted by the VCSEL; and
an angular filter disposed between the bottom surface and a detecting surface
10 of the photodetector and capable of allowing only light which reaches the angular
filter within a limited range of angles, to reach the photodetector.
2. The apparatus as in claim 1, wherein the photodetector is disposed
directly beneath the VCSEL.
- 15 3. The apparatus as in claim 1, wherein the bottom surface is polished to
reduce scattering of the light emitted by the VCSEL, within the substrate.
4. The apparatus as in claim 3, wherein an anti-reflective coating is
formed on the polished bottom surface.
- 20 5. The apparatus as in claim 1, wherein the angular filter is formed of a
multi-layered dielectric material.
6. The apparatus as in claim 1, wherein the angular filter is disposed one
25 of on the bottom surface of the substrate and on the detecting surface of the
photodetector.
7. The apparatus as in claim 1, wherein the VCSEL is coupled to an
optical transmission medium to deliver an optical data signal.
- 30 8. The apparatus as in claim 1, wherein the VCSEL is included within an
array of VCSELs formed on the top surface.

9. The apparatus as in claim 8, in which the angular filter prevents light emitted by other VCSELs of the array of VCSELs, from reaching the detecting surface of the photodetector.

5 10. The apparatus as in claim 8, further comprising adjusting means for adjusting optical output of a plurality of VCSELs of the array of VCSELs based on light detected by the photodetector.

10 11. The apparatus as in claim 1, in which the VCSEL is capable of emitting a primary light beam from the top surface and a secondary light beam through the substrate and exiting from the bottom surface, the photodetector capable of sensing the secondary light beam.

15 12. The apparatus as in claim 1, wherein the substrate comprises one of silicon and gallium arsenide.

20 13. The apparatus as in claim 1, wherein the angular filter is mounted one of on and within a further member disposed between the bottom surface of the substrate and the photodetector, portions of a top surface of the further member including an absorbing epoxy layer formed thereon and capable of absorbing light.

25 14. The apparatus as in claim 1, in which the angular filter prevents light which exits the bottom surface of the substrate at angles less than 45 degrees, from reaching the photodetector.

15. The apparatus as in claim 1, in which the angular filter includes a filter surface and wherein the limited range of angles comprise angles greater than 45° with the filter surface.

30 16. The apparatus as in claim 1, further comprising adjusting means for adjusting optical output of the VCSEL based on light detected by the photodetector.

17. An apparatus comprising:

a VCSEL (vertical cavity surface emitting laser) formed on a top surface of a substrate that is transmissive to light emitted by the VCSEL, the substrate including an opposed bottom surface being polished to reduce scattering of light emitted by the VCSEL;

5 an anti-reflective coating formed on the polished bottom surface; and
 a photodetector disposed facing the opposed bottom surface of the substrate and capable of detecting light emitted by the VCSEL.

10 18. The apparatus as in claim 17, wherein the photodetector is disposed directly beneath the VCSEL.

19. The apparatus as in claim 17, wherein the bottom surface is polished such that internal diffuse reflection is less than 1/100 of specular reflection.

15 20. The apparatus as in claim 17, wherein the anti-reflective coating is selected from the group consisting of titanium oxide, tungsten oxide, silicon monoxide, silicon dioxide and magnesium fluoride.

20 21. The apparatus as in claim 17, wherein the anti-reflective coating has a refractive index that is approximately the square-root of the refractive index of the substrate.

25 22. The apparatus as in claim 17, wherein the VCSEL is included within an array of VCSELs formed on the top surface.

30 23. The apparatus as in claim 17, in which the VCSEL is capable of emitting a primary light beam from the top surface and a secondary light beam through the substrate and exiting from the bottom surface, the photodetector capable of sensing the secondary light beam.

24. The apparatus as in claim 17, wherein the substrate comprises one of silicon and gallium arsenide.

25. The apparatus as in claim 17, further comprising an angular filter disposed between the bottom surface and a detecting surface of the photodetector and capable of allowing only light which reaches the angular filter within a limited range of angles to reach the photodetector.

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26. The apparatus as in claim 17, further comprising adjusting means for adjusting optical output of the VCSEL based on light detected by the photodetector.

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